

CLAIMS

1-39. (Cancelled).

40. (Previously Presented) A semiconductor device comprising:
a substrate;
a gallium nitride material region formed over the substrate;
a first electrical contact formed over a portion of the gallium nitride material region;
a second electrical contact formed over a portion of the gallium nitride material region; and
at least one via extending from a first side of the semiconductor device and having electrically conductive material formed therein, the electrically conductive material being electrically connected to the first electrical contact.

41. (Original) The semiconductor device of claim 40, wherein the first electrical contact is formed over a first portion of the gallium nitride material region and the second electrical contact is formed over a second portion of the gallium nitride material region, wherein the first portion and the second portion are on different planes.

42. (Original) The semiconductor device of claim 40, wherein the first electrical contact is formed over a first portion of the gallium nitride material region and the second electrical contact is formed over a second portion of the gallium nitride material region, wherein the first portion and the second portion are on the same plane.

43. (Cancelled).

44. (Previously Presented) The semiconductor device of claim 40, further comprising a transition layer formed between the substrate and the gallium nitride material region.

45. (Previously Presented) The semiconductor device of claim 44, wherein the transition layer is compositionally-graded and further comprising a constant composition transition layer formed

between the substrate and the compositionally-graded transition layer, the constant composition transition layer comprising a gallium nitride alloy, aluminum nitride, or an aluminum nitride alloy.

46. (Cancelled).

47. (Original) The semiconductor device of claim 40, wherein the semiconductor device is a light emitting device.

48. (Original) The semiconductor device of claim 47, wherein the semiconductor device is an LED.

49. (Original) The semiconductor device of claim 40, wherein the semiconductor device is a light-detecting device.

50-105. (Cancelled)

106. (Previously Presented) The semiconductor device of claim 40, further comprising a third electrical contact.

107. (Previously Presented) The semiconductor device of claim 106, wherein the first electrical contact is a source electrode, the second electrical contact is a drain electrode, and the third electrical contact is a gate electrode.

108. (Previously Presented) The semiconductor device of claim 40, wherein the at least one via extends from a backside of the semiconductor device.

109. (Previously presented) The semiconductor device of claim 40, wherein the electrically conductive material comprises a first material and the device further comprises a layer of a second

material, different than the first material, is formed between a portion of the first material and a sidewall of the via.

110. (Previously Presented) The semiconductor device of claim 109, wherein the first material is gold.

111. (Previously Presented) The semiconductor device of claim 40, wherein the electrically conductive material comprises titanium and gold.

112. (Previously Presented) The semiconductor device of claim 40, wherein the device is a transistor.

113. (Previously Presented) The semiconductor device of claim 40, further comprising at least one non-conducting layer formed between the substrate and the gallium nitride material region.

114. (Previously Presented) The semiconductor device of claim 40, wherein the gallium nitride material region includes a GaN layer and an AlGaN layer formed on the GaN layer.

115. (Previously Presented) The semiconductor device of claim 40, wherein the via extends to a source region of the device.

116. (Previously Presented) The semiconductor device of claim 40, wherein the via extends to the gallium nitride material region.

117. (Previously presented) The semiconductor device of claim 40, wherein the substrate is a silicon substrate.

118. (Previously presented) The semiconductor device of claim 117, further comprising a transition layer comprising a gallium nitride alloy between the silicon substrate and the gallium

nitride material layer, wherein a gallium concentration in the transition layer is increased from a back surface of the transition layer to a top surface of the transition layer.

119. (Previously presented) The semiconductor device of claim 117, wherein the gallium nitride material region has a thickness of greater than 0.5 micron and a crack level of less than 0.005 micron/micron².

120. (Previously presented) The semiconductor device of claim 119, wherein the gallium nitride material region has a thickness of greater than 1.0 micron.

121. (Previously presented) The semiconductor device of claim 40, wherein the substrate is a sapphire substrate.

122. (Previously presented) The semiconductor device of claim 40, wherein the substrate is a silicon carbide substrate.

123. (Previously presented) The semiconductor device of claim 40, wherein the via extends from a backside of the semiconductor device to a topside of the semiconductor device.

124. (Previously presented) The semiconductor device of claim 40, wherein the electrically conductive material extends from a backside of the semiconductor device to a topside of the semiconductor device.

125. (Previously presented) The semiconductor device of claim 40, wherein the electrically conductive material is formed, in part, on a backside of the semiconductor device.

126. (Previously presented) The semiconductor device of claim 40, wherein the electrically conductive material is in direct contact with the first electrical contact.

127. (Previously presented) The semiconductor device of claim 40, wherein the first electrical contact is formed, in part, from the electrically conductive material formed in the via.

128. (Previously presented) The semiconductor device of claim 127, wherein the first electrical contact extends to a backside of the semiconductor device.

129. (Previously presented) The semiconductor device of claim 128, wherein the first electrical contact extends from a topside of the semiconductor device to the backside of the semiconductor device.

130. (Previously presented) The semiconductor device of claim 128, wherein the first electrical contact is formed, in part, on the backside of the semiconductor device.

131. (Previously presented) The semiconductor device of claim 127, wherein the first electrical contact is contacted by a power source at the backside of the semiconductor device.

132. (Previously presented) The semiconductor device of claim 127, further comprising a third electrical contact.

133. (Previously presented) The semiconductor device of claim 132, wherein the first electrical contact is a source electrode, the second electrical contact is a drain electrode, and the third electrical contact is a gate electrode.

134. (Previously presented) The semiconductor device of claim 127, wherein the via extends from a topside of the semiconductor device.

135. (Previously presented) The semiconductor device of claim 127, wherein the substrate is a silicon substrate.

136. (Previously presented) The semiconductor device of claim 135, further comprising a transition layer comprising a gallium nitride alloy between the silicon substrate and the gallium nitride material layer, wherein a gallium concentration in the transition layer is increased from a back surface of the transition layer to a front surface of the transition layer.

137. (Previously presented) The semiconductor device of claim 135, wherein the gallium nitride material region has a thickness of greater than 0.5 micron and a crack level of less than 0.005 micron/micron².

138. (Previously presented) The semiconductor device of claim 137, wherein the gallium nitride material region has a thickness of greater than 1.0 micron.

139. (Previously presented) The semiconductor device of claim 127, wherein the device is a transistor.

140. (Previously presented) The semiconductor device of claim 127, further comprising at least one non-conducting layer formed between the substrate and the gallium nitride material region.

141. (Previously presented) The semiconductor device of claim 140, wherein the electrically conductive material extends through the non-conducting layer.

142. (Previously presented) The semiconductor device of claim 127, wherein the gallium nitride material region includes a GaN layer and an AlGaN layer formed on the GaN layer.

143. (Previously presented) The semiconductor device of claim 127, wherein the electrically conductive material is formed on sidewalls of the via.

144. (Previously presented) The semiconductor device of claim 40, wherein the electrically conductive material is formed on sidewalls of the via.

145. (Previously presented) The semiconductor device of claim 40, wherein the via extends from a backside of the semiconductor device to a position within the gallium nitride material region such that the electrically conductive material is separated from the first electrical contact at least in part by a portion of the gallium nitride material region.